

## **CT Basics—Nano CT**

### **What kind of sample can be scanned in the nano-CT?**

Samples can be smaller than 1 mm<sup>3</sup> up to about 30 x 30 x 30 cm. We have scanned plant, insect, and vertebrate animal specimens, metals, fabrics, and engineered materials, archaeological artifacts, fossils, and stone.

An ideal sample, which will give the highest quality image with the shortest scan time, is:

- About the size of the desired field of view
- Able to fit into a cylinder (no large protrusions such as branches etc that may crash into the detector)
- Stable and unmoving for the duration of the scan.

Live animals cannot be imaged in the nano-CT.

### **What resolution can I get? How large a volume can be scanned?**

The resolution of the Xradia is in a continuous range between about 0.8um to 40 um/pixel, and higher and/or lower resolution is possible depending on specimen properties.

We will return data to you that is approximately 1000x1000x1000 pixels in volume, so the field of view is directly proportional to the resolution. For example, a resolution of 10um will scan a volume of about 1 cm<sup>3</sup>, while a resolution of 1um will scan a volume of about 1mm<sup>3</sup>. We can perform multiple scans to stitch together data upon request.

### **Do I need to stain my sample?**

It depends on the structures you want to see. Researchers looking at soft tissue structures or plant cells are generally more satisfied with their results after CT staining. Contact BRC Imaging staff for assistance.

### **How should I prepare my sample?**

For most samples, we can scan them as-is, or with minimal preparation aside from staining. We will sometimes mount a sample with cyanoacrylate glue—please let us know if this is inappropriate for your sample.

-Metals: Metal strongly scatters x-rays, so the smallest diameter that still yields useful information is best (specimens smaller than 1cm in diameter are best)

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Ceramic or polymer materials: Can generally be imaged as-is. Please discuss your needs with the CT staff first.

-Inorganic samples (fossils etc): can usually be imaged as-is. Soil samples should be in a small plastic container like a conical tube.

-Fabrics/fibers/threads: A few cm of thread or a piece of fabric at least a few mm across is usually best. Please discuss with CT staff prior to your scan if you have any particular imaging requirements (under tension, folded, etc).

-Plant specimens: samples can be stored in fluid in centrifuge tubes, mounted in paraffin blocks, or imaged as-is. Removing the specimen from the plant is usually preferable but not always necessary.

-Small animal specimens/organs (less than  $\sim 1 \text{ cm}^3$ ): We can usually scan these as-is. Imaging through plastic is better than glass; a 15- or 50- mL conical tube is a suitable container. Since a floating sample may move during imaging, we may constrain the sample with a piece of foam prior to scanning.

-Larger animal specimens preserved in alcohol: We will typically remove the animal from its container and place it in a sealed leakproof bag prior to imaging.

-Bone or shell: Can usually be imaged as-is.

### **How long will a scan take?**

This depends on the material, the contrast needed, and the resolution required. Estimates of typical scan times below assume sample diameters roughly equal to the field of view. Thicker or highly-scattering specimens may take longer.

15-40 microns/pixel: 1-4 hours

7-15 microns/pixel: 1-3 hours

5-7 microns/pixel: 3-6 hours

2-4 microns/pixel: 2-6 hours

1-2 microns/pixel: 8-12 hours

0.5-1-micron: 4-10 hours

<0.5 micron: 9-20 hours

### **What is the turnaround time for my sample?**

For single samples, we can typically return data in under a week. The turnaround time for larger sets of samples depends on how these scans fit in with the current queue. If we can schedule scans in advance it's usually easier to guarantee a particular timeline. Contact CT staff for time estimates.

### **How can I look at my data? What format is it in?**

You will receive data in either a DICOM or tiff format, where each image is a single slice from the reconstructed CT data. If you want a video or 3D analysis to be performed, please discuss this with the staff beforehand for a price estimate.

For researchers on campus, we can give you access to Avizo and Osirix, 3D image processing programs. Users outside Cornell will need to purchase appropriate imaging and analysis software.

### **Can you do a test run of my sample?**

Yes! We're happy to work with you to figure out if CT is appropriate for your samples.

For preliminary proof-of-principle scans (<1 hr), we will scan your specimen free of charge.

If you want to determine the best parameters for your specimen, we will generally do 2-3 different scans and charge only for whichever parameters are most satisfactory moving forward.

### **Can I run samples myself?**

No. The nano-CTs are only run by BRC staff.

### **I need old data to be resent or reconstructed again. Can you do that?**

We hold onto reconstructed CT data for 3 years in backed up, secure servers. If you have a file name or date when the scan was performed, we should be able to track it down.

Raw data (pre-reconstruction) is held onto for one month before deleting, due to computer space considerations.

### **What are the steps I need to take to have my sample scanned at the BRC Imaging Facility?**

- 1) Plan your experiment, read this document, and contact the BRC Imaging staff with any preliminary questions, quote requests, etc.
- 2) Create a BRC account at <https://cores.lifesciences.cornell.edu/userdev/index.php> . Include your Cornell Account number or send in a PO. Scans will not be performed until a payment method is in place.
- 3) Ship your samples or bring them to B46 Weill Hall. Samples brought in person can be left in the black cabinet on the "IN" shelf.
- 4) Data will be sent via Cornell Box as it is taken, with a final confirmation email sent once the work has been complete. Work is typically billed at the end of any month that work has been performed.